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FOREST SURVEY RELEASE NO. 31

MARCH 12, 1938

FOREST RESOURCES OF NORTHWEST LOUISIANA

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A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

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SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

INDEXED

FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release contains Forest Survey data that will be included in complete reports to be published later. It should therefore be regarded as a progress report. Although considered reliable, the data are subject to correction or amplification as the work of computation proceeds.

Staff Assignment

In Charge of Field Work and Preparation of Report
James W. Cruikshank - Associate Forest Economist

In Charge of Computations
P. R. Wheeler - Associate Forest Economist

FOREST RESOURCES OF NORTHWEST LOUISIANA

General Description of the Unit

The production of forest commodities is a leading factor in the land economy of northwest Louisiana, where over 62 percent of the area is classified as forest. The forests of the uplands are a mixture of shortleaf and loblolly pines with hardwoods, while the bottomlands along the rivers and larger bayous support a mixture of oaks, gums, cypress, and other species. Including a large proportion of the "hill parishes" of Louisiana, the territory covered in this report consists of 11 complete and 4 partial parishes in the northwest corner of the State, totaling 6,142,000 acres (map, fig. 3). The alluvial delta of the Mississippi borders the unit on the east, while the southern boundaries of DeSoto, Red River, Winn, and Caldwell Parishes mark its southern limits. Shreveport, the largest city of the unit, is an important trading and manufacturing center, as is Monroe, on the Ouachita River just outside the eastern boundary of the unit. Agriculture and forest industries are the chief activities of the rural population. Development of new oil fields, like the one at Rodessa, has caused marked increases in the industrial activity of certain localities.

The unit, which is entirely within the Gulf Coastal Plain, consists of rolling country sloping slightly toward the southeast. Elevations range from 50 to 400 feet above sea level. The Red River with its tributaries drains the western and southern parts of the unit, while several large bayous flowing into the Ouachita River drain the northern and eastern portions. All of these streams flow south or southeastward. Owing to the nature of the soil, the rolling topography, and the abundant rainfall, sheet erosion is a serious problem on much of the agricultural upland. Rainfall averages about 50 inches per year, with the wettest months in the winter season. The winters are short and mild, the summers long and warm.

Seven main railroad systems cross the area, and several secondary lines connect these with outlying points. In recent years paved highways have been constructed throughout the area, so that at present few points exist that are not readily available to motor transportation. Barges operate on the Ouachita River along the eastern boundary of the unit, and the Red River is classified by the U. S. Engineers as navigable, during the first 6 months of the year, to small craft drawing less than 4 feet of water.

The population, which was 394,000 in 1930, has increased 62 percent since 1900. Seventy-two percent of the population live on farms or in small towns. Of the people employed 51 percent are in agriculture, a large proportion of whom are also employed in the forest industries. Caddo Parish has the largest population and has shown the most rapid increase in recent years.

Agriculture is conducted in this unit on many small farms, scattered throughout the second-growth forest stands. The chief exception is in the Red River bottom, where there are several cotton plantations each of which is a few thousand acres in extent. In 1935 there was in the unit a total of 50,000 farms, containing approximately 3,200,000 acres. The average farm contains 33 acres available for crops, 24 acres of forest land, and 7 acres of nonforested pasture. The number of farms decreased by 1.4 percent between 1930 and 1935, but the area in farms increased nearly 300,000 acres during the

same period. Apparently most of this increase in farm area remained in forest, since land available for crops increased less than 10,000 acres. On the basis of the Forest Survey classification, 178,300 acres of agricultural land were standing idle, and 57,000 were definitely abandoned. General crops are grown, such as cotton, corn, hay, sweet and Irish potatoes, sugar cane, and oats. Cattle are produced on practically every farm. The average value of the individual farm in 1935 was $1,344; and the average value per acre, including both forested and cleared land, ranged from $47.64 in Caddo Parish to $11.88 in Union Parish.

Farms, with their included forest land, occupy 52 percent of the area of the unit. These farms are in the hands of 50,000 operators, 33 percent of whom are full or part owners, while 67 percent are tenants. Large land holdings by lumber and paper companies are common in this unit, where at least 12 individual companies hold more than 100,000 acres each.

Tax delinquency is not as serious a problem in this unit as in some other sections of Louisiana. Data collected by the State Land Planning Consultant of the National Resources Board show that, as of November 1934, the State held lien to 9.0 percent of the area for non-payment of taxes. Since new oil discoveries are being made in the unit, it can be expected that delinquency will be even further reduced, as anticipated oil production and revenue from leases furnish an incentive to retain the land with a clear title. In general, cut-over forest land stocked to second growth is assessed for taxes at $2.00 to $9.00 per acre, with tax rates varying from about 15 to 45 mills.

Table 1. - Land area classified according to land use

Land use	Area		Proportion of total area	
	Acres		Percent	
Forest:				
Productive	3,826,400		62.3	
Nonproductive	15,300		0.2	
Total forest		3,841,700		62.5
Nonforest:				
Agricultural:				
In cultivation:				
Old cropland	1,532,000		25.0	
New cropland	111,700		1.8	
Out of cultivation:				
Idle	178,300		2.9	
Abandoned	57,000		0.9	
Pasture	226,600		3.7	
Total agricultural	2,105,600		34.3	
Other nonforest	194,700		3.2	
Total nonforest areas		2,300,300		37.5
Total forest and nonforest		6,142,000		100.0

Description of the Forest

A large proportion of the forest area is in a hilly or rolling region, characterized by the reddish brown soils of the Orangeburg and Ruston series. Nearly 72 percent of the forest area is in rolling uplands, 11 percent in river bottoms, and 17 percent in swamps and low flats along the streams. The main forest stands, occupying 63 percent of the forest area, are second growth of the usual pure pine and pine-mixed hardwood association of the Upper Coastal Plain, with loblolly and shortleaf the predominant pines. Extending about 40 miles northwest from Winnfield (see fig. 3) is a narrow belt of longleaf pine, most of which has been cut over recently and has not restocked entirely. The bottomland hardwood types, also largely second growth, which occur along the Red and the Ouachita Rivers as well as along many of the smaller streams and bayous, occupy 20 percent of the forest area. Red gum, red and white oaks, black gum, and cypress, are the characteristic species of this type-group. The upland hardwood types, found on approximately 12 percent of the forest area, are closely intermingled with the pine-hardwood stands and seldom occur unbroken over any extensive area. Red and white oaks, red gum, and hickory, which are the common species in this type-group, are generally of much poorer quality than when found in the bottomlands.

Table 2. - Forest area classified according to forest condition and forest type-group

Forest condition	Shortleaf and loblolly 1/	Shortleaf-loblolly-hdwds. 2/	Upland hardwoods	Bottomland hardwoods	Total all types	Proportion of total
			Acres			Percent
Old growth:						
Uncut	26,500	34,600	54,600	118,900	234,600	6.1
Partly cut	37,000	49,000	52,200	128,500	266,700	7.0
Total	63,500	83,600	106,800	247,400	501,300	13.1
Second growth:						
Sawlog size:						
Uncut	663,600	365,500	76,300	184,800	1,290,200	33.7
Partly cut	431,400	343,000	118,900	141,400	1,034,700	27.1
Under sawlog size	237,800	302,900	140,700	183,100	864,500	22.6
Reproduction	18,500	30,500	32,900	18,500	100,400	2.6
Total	1,351,300	1,041,900	368,800	527,800	3,289,800	86.0
Clear-cut	31,300	800	1,600	1,600	35,300	0.9
Total all conditions	1,446,100	1,126,300	477,200	776,800	3,826,400	100.0
Percent of total forest area	37.8	29.4	12.5	20.3	100.0	

1/ Includes 75,500 acres of longleaf types.
2/ Includes 6,400 acres of longleaf-hardwood type.

In "pure" pine types, the pine component makes up 85 percent of the net cubic volume of the stand, while in the pine-mixed hardwood types the pine is only 48 percent of the total. Red gum and red and white oaks account for 58 percent of the net cubic volume in the bottomland hardwood types, but black gum, cypress, ash, hickory, and some loblolly pine are also found. An analysis of the net cubic volume on the total forest area reveals that loblolly pine, accounting for 30 percent of the total, is the leading species. Other important species rank as follows: shortleaf, 23 percent; red gum, 12 percent; red oaks, 9 percent; white oaks, exclusive of post oaks, 6 percent.

As shown in table 2, forest stands classified as old growth occupy 13.1 percent of the total forest area. As in many other Survey units, a large portion of the old-growth area is in the bottomland hardwood types; and of the total area in bottomland hardwoods, 31.8 percent is in the old-growth condition. That the forest is predominately young is evidenced by the fact that 86.0 percent of the forest area, all types included, bears second-growth timber, of which nearly one-third is in the under-sawlog and reproduction conditions. Clear-cut forest land, found chiefly in the pure pine types, occurs on less than 1 percent of the forest area.

The basal area of the average acre in the pine-hardwood association is shown by diameter-classes in figure 1. It is apparent that the 8- and 10-inch

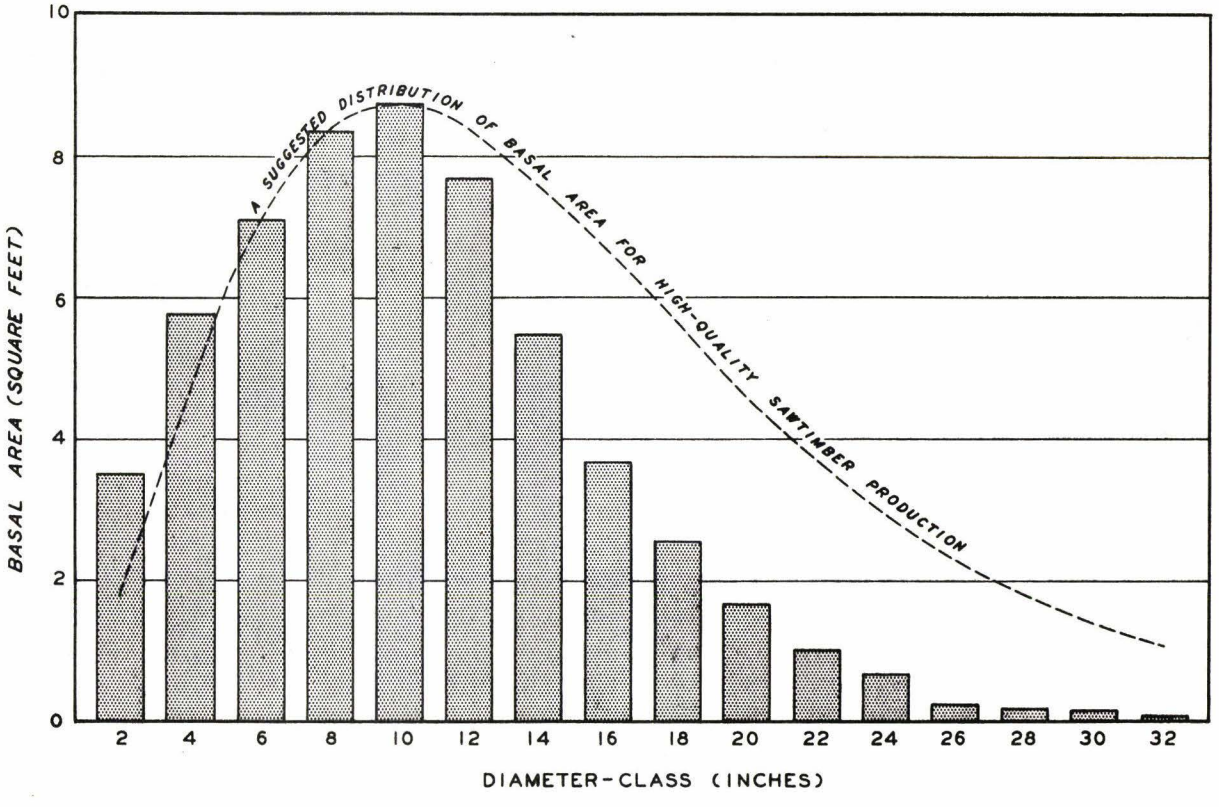

FIGURE 1.- PRESENT BASAL AREA ON THE AVERAGE ACRE IN THE PINE AND PINE-HARDWOOD TYPES WITH A SUGGESTED DISTRIBUTION FOR HIGH-QUALITY TIMBER PRODUCTION

trees make up a high proportion of the basal area on the acre, while trees in the larger diameter-classes, where quality and volume produce greater financial returns, are relatively scarce. This deficiency in larger trees is brought out by the curved line in the chart which represents a suggested desirable distribution of basal area, assuming that high-grade sawtimber is to be the object of management. This suggested curve does not attempt to represent the maximum basal area obtainable but rather indicates a forest stand well within the possibilities of the present forest, if it were given reasonably good management for the next 30 to 40 years.

A summation of the number of trees by diameters, all species combined, shows that about 52 percent of the stems are in the 2-inch diameter-class, and that 88 percent are less than 9 inches in diameter. Only 8 percent of the trees are large enough for sawtimber, if 13.0 inches for hardwood and 9.0 inches for pine are considered as minimum diameters.

Figure 2 is a graphic representation of the age-classes in the forest stand in the pine and pine-hardwood types. In this figure the horizontal axis at the bottom represents the total area in these types, divided to represent the proportionate area in the various age-classes. Predominant in area are the stands between 20 and 60 years of age, while stands over 70 years old are found on only a little more than 5 percent of the pine and pine-hardwood areas. The line formed by the upper limit of the shaded area represents the volumes per acre of average stands of various ages. The declining volume from 40 to 60 years is believed to be a result of partial cutting in the past and probably does not truly delineate the volume possibilities of an undisturbed stand. The shaded area denotes the cubic volume in stands within a

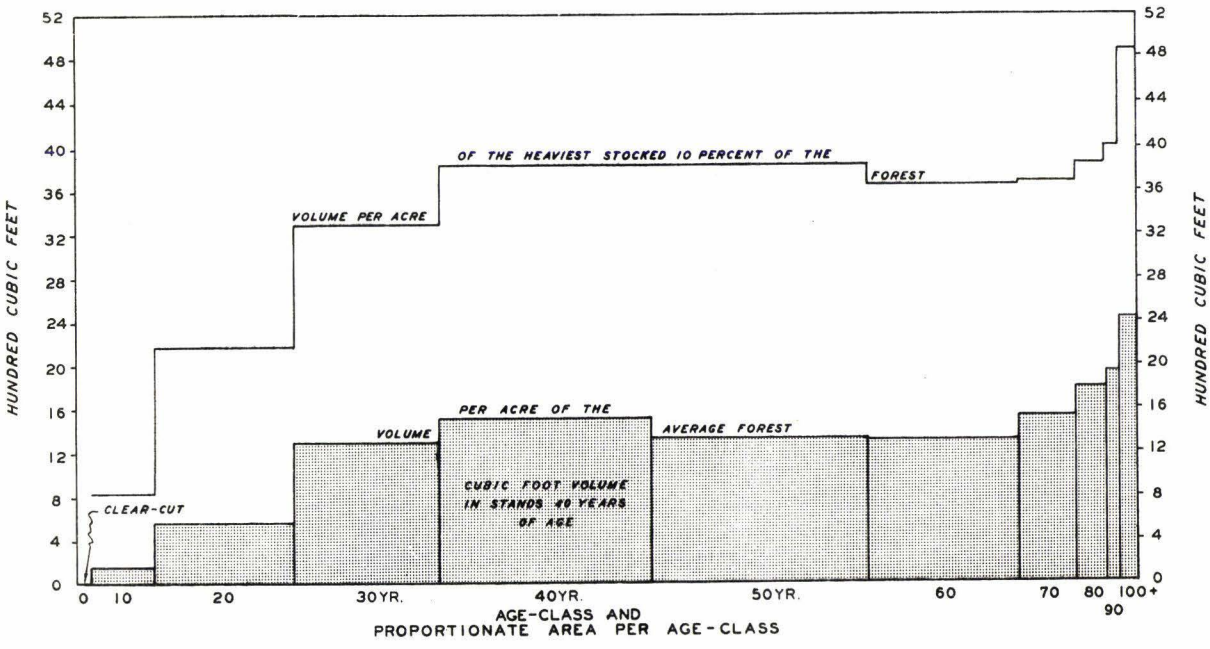

FIGURE 2.- AREA DISTRIBUTION OF AGE-CLASSES AND COMPARISON OF THE VOLUMES IN AVERAGE AND HEAVIEST STOCKED STANDS IN THE VARIOUS AGE-CLASSES

given age-class; and it is significant that a very minor proportion of the total cubic volume on the area is in stands above 70 years of age. The upper line represents the volume per acre attained at various ages by the best 10 percent of the stand and affords some measure of the wide field for improvement in stocking to be obtained by bringing the present under-stocked average stands up to the stocking achieved by the better stands. If it is assumed that the best 10 percent of the stand represents normal stocking, the average stand in the pine and pine-hardwood types is only 40 percent stocked.

Volume Estimates

Board-foot volume

In the estimates given in table 3, the stand of sound sawlog-size trees is expressed in terms of board feet as measured by the Doyle log rule. The volumes are net log scale, that is, allowance has been made for material that would be left in the woods because of rot, fire scar, crook, limbiness, and similar defects, as well as for loss in sawing at the mill due to sweep and hidden defects.

To be classified as sawlog-size trees, hardwoods must have a minimum d.b.h. (diameter at breast height) of 13 inches, and pines of 9 inches; also they must contain one sound butt log at least 12 feet long, or have at least 50 percent of their gross volume in sound material. The volume of the stem is included to the upper limit of usable material in the tops rather than to a fixed top-diameter, but no pine logs less than 5.5 inches in diameter, inside bark at the small end, or any hardwood logs less than 8.5 inches, are included.

The total board-foot volume by the Doyle rule is 7½ billion feet, nearly 99 percent of which is found in sufficient volume per acre (at least 400 board feet) to be classified as sawtimber stands. These stands occupy 74 percent of the forest area and average 2,600 board feet per acre.

Accessibility, as related to transportation and logging conditions, is not a restricting factor in utilization of the forest stands in this unit, as indicated by the fact that 94 percent of the forest area has already been logged over with varying degrees of intensity. With the rapid liquidation of the present old-growth stands, in only a few years the accessibility of all parts of the area will have been demonstrated.

About 30 percent of the total sawtimber volume is found in the old-growth condition. Only 17 percent of the pine volume occurs in this condition, however, as compared with 45 percent of the hardwood volume. In the old-growth uncut condition, the average stand per acre in the pure pine types is 12,700 board feet (lumber tally), in the shortleaf-loblolly-hardwood types 8,900 feet, in the upland hardwood types 3,200 feet, and in the bottomland hardwood types 6,900 feet.

The second-growth stands occupy 86 percent of the forest area and contain about 70 percent of the total sawtimber volume. In the second-growth sawlog-size uncut stands, the pure pine types average 5,200 board feet per acre (lumber tally), while the shortleaf-loblolly-hardwood types average 3,900 feet. The upland hardwood types of a similar condition average 2,200 feet, and the bottomland hardwood 3,300 feet.

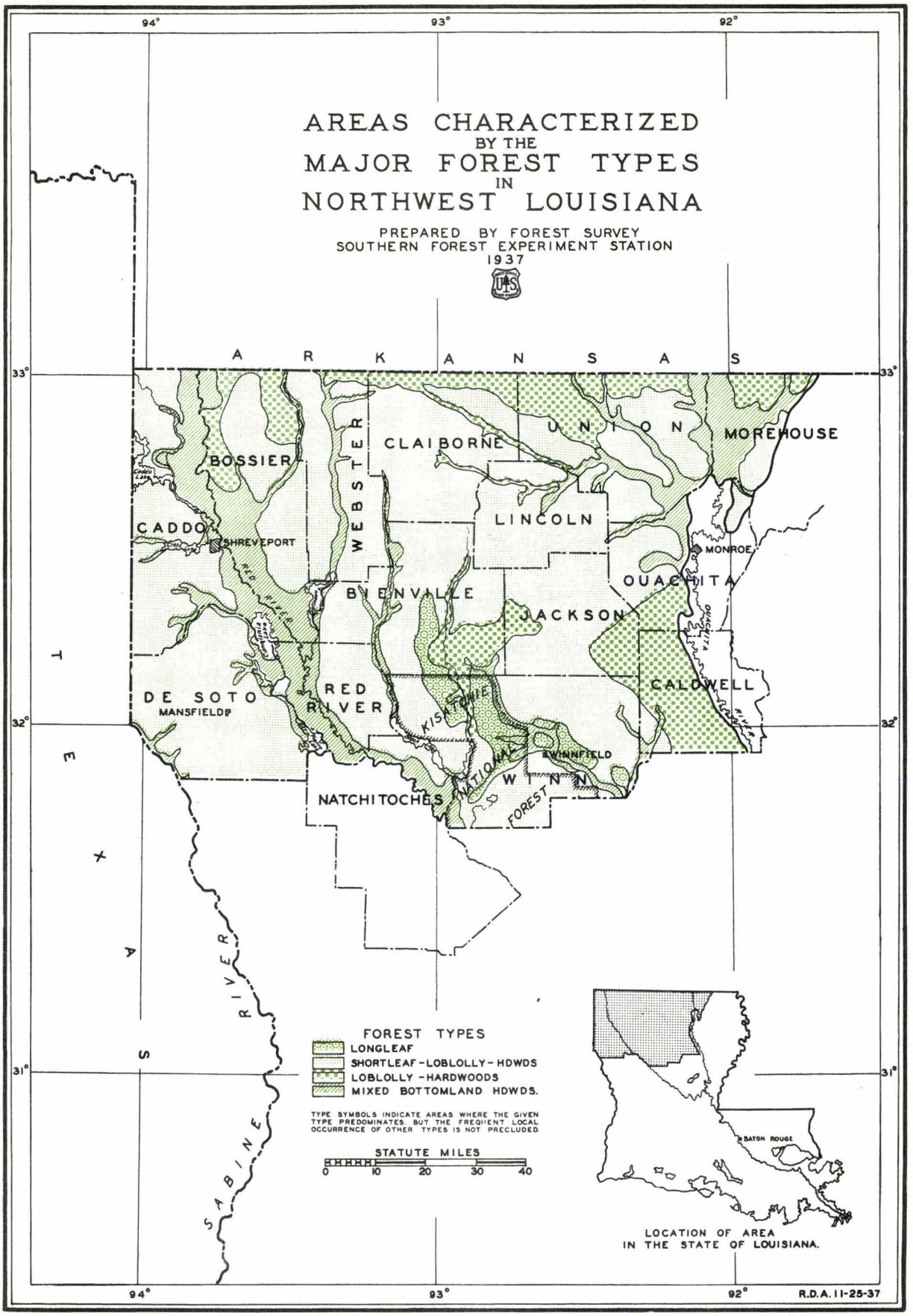
AREAS CHARACTERIZED
BY THE
MAJOR FOREST TYPES
IN
NORTHWEST LOUISIANA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
1937
94°
93°
92°
33°
32°
31°
ARKANSAS
TEXAS
BOSSIER
CADDO
SHREVEPORT
WEBSTER
CLAIBORNE
UNION
MOREHOUSE
LINCOLN
MONROE
OUACHITA
BIENVILLE
JACKSON
CALDWELL
DE SOTO
MANSFIELD
RED RIVER
KISATCHIE
NATIONAL
FOREST
WINN
WINNFIELD
NATCHITOCHES
SABINE RIVER
FOREST TYPES
LONGLEAF
SHORTLEAF-LOBLOLLY-HDWDS
LOBLOLLY-HARDWOODS
MIXED BOTTOMLAND HDWDS.
TYPE SYMBOLS INDICATE AREAS WHERE THE GIVEN TYPE PREDOMINATES, BUT THE FREQUENT LOCAL OCCURRENCE OF OTHER TYPES IS NOT PRECLUDED.
STATUTE MILES
0 10 20 30 40
BATON ROUGE
LOCATION OF AREA
IN THE STATE OF LOUISIANA.
R.D.A. 11-25-37

FIGURE 3.

An analysis of the upland hardwood types, all forest conditions combined, shows that stands containing 1,000 or more board feet per acre are found in 53 percent of the type area. In the bottomland hardwood types, however, the stands are heavier; here 71 percent of the total area has a volume of at least 1,000 feet per acre.

Table 3. - Net volume (Doyle) classified according to species-group and forest condition

Species-group	Old growth		Second growth		Total	Proportion of total
	Uncut	Partly cut	Sawlog size	Under sawlog size 1/		
	Thousand board feet					Percent
Pines:						
Longleaf	-	46,300	27,400	1,700	75,400	1.0
Shortleaf	154,900	140,800	1,239,800	22,400	1,557,900	20.8
Loblolly	232,900	124,800	2,027,000	28,400	2,413,100	32.2
Total pines	387,800	311,900	3,294,200	52,500	4,046,400	54.0
Pulping hardwoods:						
Red gum	178,600	137,800	464,500	7,000	787,900	10.5
Black and tupelo gum	75,600	43,500	192,000	2,600	313,700	4.2
Others 2/	64,300	30,600	107,200	2,700	204,800	2.7
Nonpulping hardwoods:						
Red oaks	145,200	159,700	390,500	13,300	708,700	9.5
White oaks	244,000	138,500	232,900	10,800	626,200	8.4
Post oak	45,800	60,800	193,100	9,000	308,700	4.1
Ash	10,700	9,400	17,400	1,100	38,600	0.5
Hickory	25,100	27,900	111,400	3,200	167,600	2.2
Others	83,900	57,300	146,400	3,300	290,900	3.9
Total hardwoods	873,200	665,500	1,855,400	53,000	3,447,100	46.0
Total all species	1,261,000	977,400	5,149,600	105,500	7,493,500	100.0
Percent of total	16.8	13.1	68.7	1.4	100.0	

1/ Includes areas classified as reproduction and clear-cut.
2/ Includes cypress, bay, maple, cottonwood, and willow.

The Doyle rule has been used for the board-foot volume in table 3 because it is in general use throughout the South. Its chief weakness lies in underscaling the contents of trees less than 36 to 40 inches in diameter (if cut into 1-inch lumber), and trees of this size make up practically all of the sawtimber in this unit.

To arrive at an estimate closely approximating lumber tally, the volume is expressed in table 4 in the International $\frac{1}{4}$-inch kerf scale — a much more correct measure of the actual sawtimber contents of these stands than the Doyle.

Table 4. - Net volume, lumber tally, classified according to species-group and forest condition (based on International $\frac{1}{4}$-inch rule)

Forest condition	Pines	Pulping hardwoods	Nonpulping hardwoods	Total
		Thousand board feet		
Old growth:				
Uncut	536,500	407,800	692,200	1,636,500
Partly cut	458,200	280,500	574,400	1,313,100
Second growth:				
Sawlog size	5,866,100	1,113,200	1,523,200	8,502,500
Under sawlog size[1/]	114,300	20,500	59,700	194,500
Total all conditions	6,975,100	1,822,000	2,849,500	11,646,600

1/ Includes areas classified as reproduction and clear-cut on which sawtimber volume is too scattered to be available.

Cordwood volume

In estimating the cordwood volume, the entire stand of sound trees 5 inches or over in diameter, outside the bark at breast height, is expressed in terms of standard (4 ft. x 4 ft. x 8 ft.) cords. This estimate obviously includes the sawlog-size trees that have already been included in the board-foot estimate. In addition, a separate estimate of the net sound material in cull trees is included. Under "Sound trees sawlog size" in table 5, only the merchantable sawlog portion of the stem is included. The column headed "Tops of sawlog-size trees" includes the volume in that part of the stem above the sawlogs, taken to a variable diameter of not less than 4 inches inside bark; in the pines the upper stems only are included, but in the hardwoods the usable limbs are included to a 4-inch minimum diameter. The volume listed under "Sound trees under sawlog-size" includes the full stems (but no limbs) of both pines and hardwoods to a variable usable diameter, with a minimum of 4 inches. Under "Sound and rotten cull trees" is included only the sound volume found in such trees. In all classes of material, deduction from the volume has been made for woods cull, that is, that part of the tree that would be left in the woods because of rot, fire scar, crook, bad knots, or other defects.

The pine cordwood volume is practically all loblolly and shortleaf, the longleaf being of minor importance. Of the pine volume, 26 percent is in sound trees under 9 inches in diameter, 63 percent in the sawtimber portion of the sawlog-size trees, 10 percent in the tops of these trees, and the remainder in cull trees. Red gum is the leading pulping hardwood, although black gum, cypress, bay, and maple are common. In these species, 36 percent of the cordwood volume is in sound trees under 13 inches in diameter, 49 percent in sawlog-size trees, and 15 percent in cull trees. In the nonpulping hardwoods, the red and white oaks make up most of the volume; here the volume in sound and rotten culls (21 percent) is proportionately greater than in the other species-groups.

Table 5. - Net volume in various classes of sound material, expressed in cords

Species-group	Sound trees saw-log size	Tops of sawlog-size trees	Sound trees under saw-log size	Sound and rotten cull trees 1/	Total all classes	Proportion of total
			Cords			Percent
Pines	15,603,000	2,660,200	6,440,600	194,600	24,898,400	40.6
Hardwoods:						
Pulping	4,544,700	2,314,100	5,138,000	2,178,800	14,175,600	23.1
Nonpulping 2/	6,624,100	3,862,800	7,082,400	4,748,100	22,317,400	36.3
Total hardwoods	11,168,800	6,176,900	12,220,400	6,926,900	36,493,000	59.4
Total all species	26,771,800	8,837,100	18,661,000	7,121,500	61,391,400	100.0
Percent of total	43.6	14.4	30.4	11.6	100.0	

1/ Scrub oak volume is included with nonpulping hardwoods.
2/ Hardwood species not commonly used for pulpwood, although certain of these species have been used experimentally.

The estimate of cordwood volume classified according to species-group and diameter of trees is shown graphically in figure 4. The volume shown here does not include scrub oak, cull trees, or tops and limbs of sawlog-size hardwood trees, but it does comprise all sound trees down to, and including, 5.0 inches d.b.h.

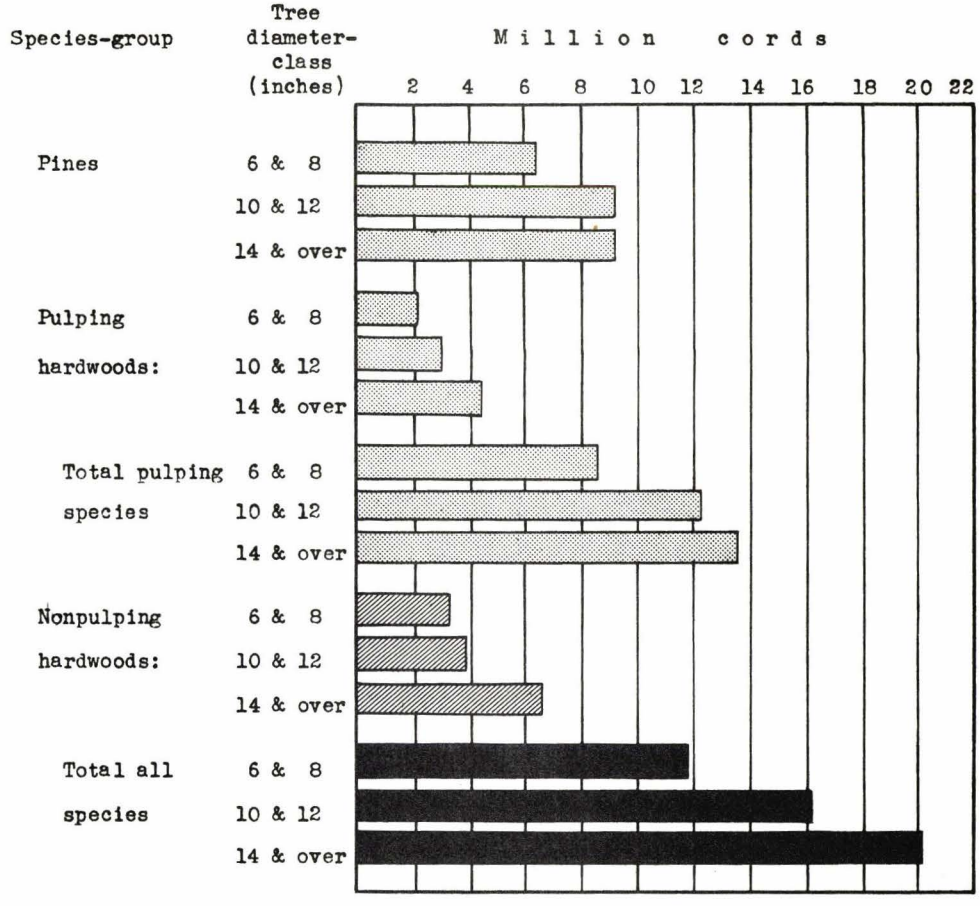

Figure 4. - Cordwood volume of pulping and nonpulping species

Pine pole and pile estimate

In table 6 is shown the estimated number of pine poles and piles that will meet the specifications of the American Standards Association. Although this estimate probably is low, because experience shows that the difficulty of accurately judging standing trees as to their suitability for poles or piles leads to the making of conservative estimates, the indicated proportions of lengths and sizes very closely approach their actual occurrence in the forest stands. The volume in these poles and piles is included in the volume estimates shown in previous tables.

Table 6. - Total number of pine poles or piles, classified according to length and diameter

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Proportion of total
	20	25	30	35	40	45	50 or over		
Inches	Thousand sticks								Percent
7.0 - 8.9	3,782	1,073	489	87	-	-	-	5,431	33.6
9.0 - 10.9	1,832	1,263	1,105	479	257	196	32	5,164	31.9
11.0 - 12.9	623	746	932	422	241	196	144	3,304	20.4
13.0 - 14.9	122	289	507	219	145	102	103	1,487	9.2
15.0 - 16.9	10	84	235	95	61	42	45	572	3.5
17.0 - 18.9	-	16	103	38	29	16	23	225	1.4
Total	6,369	3,471	3,371	1,340	733	552	347	16,183	100.0
Percent of total	39.4	21.5	20.8	8.3	4.5	3.4	2.1	100.0	

Forest Increment

A forest is a constantly changing community of trees of all sizes and ages. It increases its volume through the annual addition of wood to the individual trees and through the continuous influx of young trees that attain measurable volume, but this increase is partly offset by the death of standing trees and the loss of material in live trees due to decay or injury. The resulting balance, whether plus or minus, is known as forest increment.

Current annual increment percent

Table 7 shows the increment rates of the forest stands in the various forest conditions, and also the increment rates of the pine and hardwood species-groups that make up these stands. These rates apply only to the year 1935 and do not hold as an average for a given 10-year period. The influx of small trees into the larger size-classes is largely responsible for the high rates shown in the under-sawlog-size condition. The increment rates shown are based upon the measurement of stands that have suffered throughout their entire history from the effects of frequent forest fires and shortsighted cutting practices. As a consequence, these stands are only partly stocked and

contain accumulations of damaged and slow-growing trees, the presence of which exerts a marked and unfavorable effect upon the growth of the stand. The application of widespread effective protection from fire and the practice of wise cutting rules should result in materially improving the increment. The data shown in table 7, as well as those in table 8, apply to the entire forest area and can be used on smaller areas only when it has been determined that the forest stands are typical of the forests of the unit.

Table 7. - Rate of increase (current annual increment percent) in 1935 of stands in the various forest conditions 1/

Forest condition	Pine component		Hardwood component		Weighted average	
	Board feet	Cords	Board feet	Cords	Board feet	Cords
	Percent					
Old growth:						
Uncut	2.4	2.5	2.3	2.3	2.4	2.3
Partly cut	4.1	3.8	2.8	2.7	3.3	3.0
Second growth:						
Sawlog size:						
Uncut	6.8	5.0	5.3	4.2	6.4	4.7
Partly cut	6.1	4.0	5.3	3.7	5.8	3.9
Under sawlog size	45.2	15.9	21.1	9.0	35.3	11.7
Reproduction and clear-cut	7.3	7.8	4.5	7.2	6.2	7.5
Weighted averages	6.7	5.1	4.4	4.0	5.8	4.6

1/ Data rounded to nearest 0.1 percent.

Increment per acre

The increment per average acre in 1935 in the various forest conditions, all forest types combined, is given in table 8. It is the increment that would have accrued if the growing stock had remained undisturbed by cutting throughout the year. The per-acre volumes given in board feet represent only the increment on sawtimber material, while cubic-foot and cordwood volumes include the increment on the usable length of all pines above 5.0 inches d.b.h., undersawlog-size hardwoods, and the sawtimber portion of hardwoods 13.0 inches d.b.h. and larger. No limbs or cull trees were included in the calculation of increment. The bark is not included in the cubic-foot or board-foot volumes but is included in the estimates of cordwood volume.

Table 8. - Increment in 1935 on average acres (undisturbed by cutting) in the various forest conditions

Forest condition	Pine component			Hardwood component			Total per acre		
	Bd.Ft.	Cu.Ft.	Cords	Bd.Ft.	Cu.Ft.	Cords	Bd.Ft.	Cu.Ft.	Cords
Old growth:									
Uncut	56	11.2	.14	108	22.9	.34	164	34.1	.48
Partly cut	70	13.9	.18	91	20.5	.30	161	34.4	.48
Second growth:									
Sawlog size:									
Uncut	216	42.9	.56	63	18.4	.28	279	61.3	.84
Partly cut	104	19.3	.25	56	14.7	.23	160	34.0	.48
Under sawlog size	57	16.5	.23	19	13.0	.20	76	29.5	.43
Reproduction and clear-cut	2	.7	.01	1	.5	.01	3	1.2	.02
Weighted averages	122	25.1	.33	54	16.0	.24	176	41.1	.57

Forest increment within the unit

The amount of wood added by growth to the inventory in 1935 (deducting the growth on timber removed during the year in addition to mortality) was 649,000,000 board feet, green lumber tally, representing a volume increase of 5.6 percent. This does not mean that the inventory was increased to this extent, for during the year an amount nearly equal to the increment was harvested from the growing stock (see table 14). Twelve percent of the increment was in old-growth stands that have an average volume of 5,880 board feet per acre, while 79 percent was in second-growth sawlog-size stands that average 3,660 board feet per acre. Only 60 million board feet of the total increment was in areas supporting under-sawlog-size stands (which had a volume of less than 400 board feet per acre at the time of the survey), and these stands were increasing at the rate of 76 board feet per acre in 1935. Since the increment is accelerating annually, in 10 years many of these young stands will have over 1,500 board feet of sawtimber per acre.

Table 9. - Forest increment in board feet and cubic feet in the various forest conditions, 1935

Forest condition	Sawtimber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	-- Thousand board feet --			-- Thousand cubic feet --		
Old growth	29,400	48,100	77,500	5,930	10,600	16,530
Second growth:						
Sawlog size	374,400	137,300	511,700	72,900	38,610	111,510
Under sawlog size	43,900	15,300	59,200	13,590	11,080	24,670
Reproduction and clear-cut	400	100	500	100	70	170
Total all conditions	448,100	200,800	648,900	92,520	60,360	152,880

The increment is expressed in standard cords (4 ft. x 4 ft. x 8 ft.) in table 10. This material is identical with that given in cubic feet in table 9, except that bark is included, as cordwood is generally handled on an unpeeled basis throughout the South. In converting cubic feet to cords, a factor of 90 was used for pine and cypress, and 80 for hardwood.

Table 10. - Forest increment in 1935, expressed in cords, in the various forest conditions

Forest condition	Pine	Hardwood	Total
	- - - - - - - - - - - - Cords - - - - - - - - - - - -		
Old growth	76,700	156,600	233,300
Second growth:			
Sawlog size	954,500	589,200	1,543,700
Under sawlog size	184,900	174,400	359,300
Reproduction and clear-cut	1,200	1,000	2,200
Total all conditions	1,217,300	921,200	2,138,500

Forest Industries

Sawmills

During 1935 there were approximately 118 sawmills operating in the unit, as shown in table 11. These mills furnished 492,000 man-days of employment, 46 percent of which was in the woods, and 54 percent in the mill and yards. The lumber production of these mills in 1935 (see table 12) exceeded that of 1934 by 35 percent. Although field data are not available, it is estimated that the 1936 lumber cut exceeded that of 1934 by at least 60 percent. Mills cutting over 40M board feet per day are relatively few, although a new pine mill of this size was constructed at Spring Hill in 1936. The only mill in the unit with a rated daily capacity of 80M board feet or over is at Clarks.

Table 11. - Number of sawmills and extent of employment, classified according to size of mill, 1935

Daily (10 hrs.) rated capacity 1/ in M board feet	Number of mills 2/			Thousand man-days of employment		
	Pine	Hardwood	Total	In woods	In mill	Total
Under 20	77	8	85	34	57	91
20 - 39	22	2	24	70	95	165
40 and over	7	2	9	123	113	236
Total	106	12	118	227	265	492

1/ The rated capacity indicates size of mill rather than actual output.
2/ The data given here on the number of mills in the smallest class are only estimates based upon all available records and were not checked by actual count, but the figures for the larger mills are based upon field counts as well as upon records.

Other forest industries

In 1935, in addition to the 118 sawmills mentioned, there were in the unit only 14 other plants using raw material direct from the forest: 4 timber-treating plants, 3 pulp mills, 4 cooperage plants, 1 veneer plant, and 2 miscellaneous plants (see fig. 5). An additional pulp mill at West Monroe is outside of the unit but draws most of its timber supply from it, as do several sawmills a short distance outside the unit boundary. In 1936 a new treating plant was constructed at Bossier City, adjacent to Shreveport, and in 1937 construction began on a large pulp mill to be located at Spring Hill, near the Arkansas line. The production of poles, piles, cross ties, fuelwood, and fence posts is also an important activity throughout the unit. Table 12 shows the number of plants, the production of the various commodities, and the man-days of employment furnished by these various forest industries.

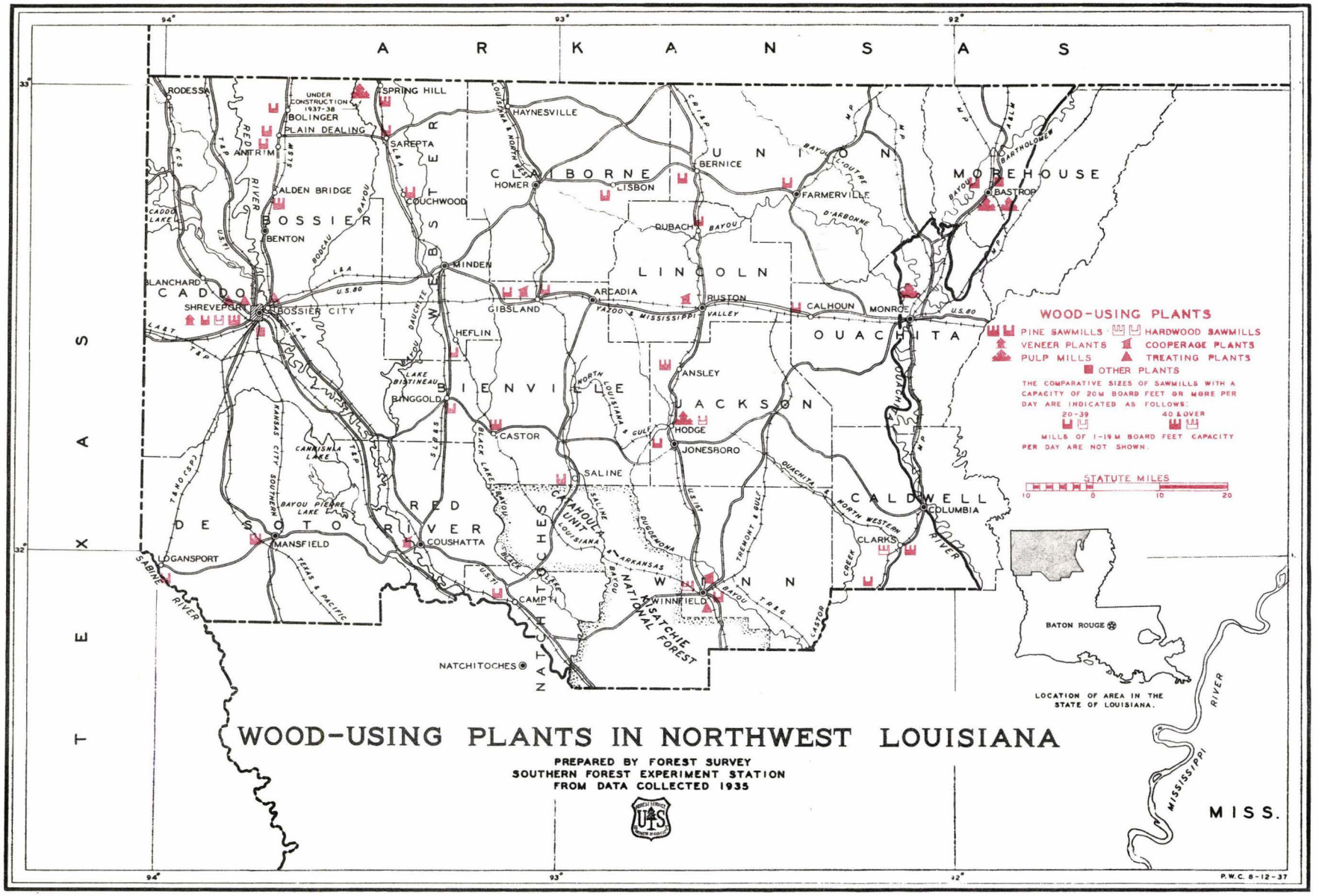
ARKANSAS
TEXAS
MISS.
94°
93°
92°
33°
32°
RODESSA
UNDER CONSTRUCTION 1937-38
BOLINGER
PLAIN DEALING
SPRING HILL
SAREPTA
RED ANT RIVER
ALDEN BRIDGE
BENTON
COUCHWOOD
HAYNESVILLE
HOMER
CLAIBORNE
LISBON
BERNICE
UNION
FARMERVILLE
MOREHOUSE
BASTROP
BARTHOLOMEW BAYOU
D'ARBONNE BAYOU
DUBACH BAYOU
BOSSIER
CADDO LAKE
BODCAU BAYOU
MINDEN
LINCOLN
BLANCHARD
CADDO
SHREVEPORT
BOSSIER CITY
ARCADIA
RUSTON
CALHOUN
MONROE
OUACHITA
GIBSLAND
HEFLIN
BAYOU DAUCHITE
LAKE BISTINEAU
BIENVILLE
ANSLEY
JACKSON
RINGGOLD
CASTOR
HODGE
JONESBORO
SALINE
CANANIA LAKE
BAYOU PIERRE LAKE
DE SOTO
RED RIVER
MANSFIELD
COUSHATTA
CATAHOULA UNIT
CALDWELL
COLUMBIA
CLARKS
LOGANSPORT
SABINE RIVER
CAMPTI
WINNFIELD
KISATCHIE NATIONAL FOREST
NATCHITOCHES
BATON ROUGE
LOCATION OF AREA IN THE STATE OF LOUISIANA.
MISSISSIPPI RIVER
WOOD-USING PLANTS
PINE SAWMILLS
HARDWOOD SAWMILLS
VENEER PLANTS
COOPERAGE PLANTS
PULP MILLS
TREATING PLANTS
OTHER PLANTS
THE COMPARATIVE SIZES OF SAWMILLS WITH A CAPACITY OF 20M BOARD FEET OR MORE PER DAY ARE INDICATED AS FOLLOWS:
20-39
40 & OVER
MILLS OF 1-19 M BOARD FEET CAPACITY PER DAY ARE NOT SHOWN.
STATUTE MILES
10 0 10 20
WOOD-USING PLANTS IN NORTHWEST LOUISIANA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1935
P.W.C. 8-12-37

FIGURE 5.

Table 12. - Production and employment data, 1935

Kind of plant or commodity	Number of plants	Amount produced or used	Thousand man-days of employment		
			In woods	In mill	Total
Sawmills	118	241,400 M bd.ft.	227	265	492
Treating plants	4	2,380 M cu.ft.	-	40	40
Cross ties	-	991 M pieces	137	-	137
Poles and piles	-	107 M pieces	20	-	20
Fence posts	-	2,037 M pieces	27	-	27
Cooperage	4	9 M cords	9	7	16
Pulpwood	3	260 M cords	371	587	958
Fuelwood	-	536 M cords	708	-	708
Miscellaneous 1/	3	11 M cords	6	16	22
Total	132		1,505	915	2,420

1/ Includes 1 veneer plant, 1 handle plant, and 1 paper-plug mill.

Employment

As seen in table 12, the production of pulpwood furnished 40 percent of the employment in the forest industries during 1935. Although often making no cash return to the individual, the labor necessary to meet the fuelwood requirements of the unit constituted 29 percent of the total for the forest industries, even exceeding that of the sawmill industry, which furnished only 20 percent of the total man-days of employment. The new pulp mill at Spring Hill will furnish nearly a million man-days of employment yearly, in the woods and mill, or slightly more than is being furnished by all three of the present pulp mills. The pulp industry in this unit will furnish about 50 percent of the forest employment by 1939, if employment in the other industries remains relatively constant and if all the pulpwood is cut within the unit except that required by the new Spring Hill plant, the greater portion of which may come from southern Arkansas.

Utilization Drain

To appraise the forest supply situation in a particular area, it is necessary to determine the annual drain for industrial requirements on the growing stock of sound trees, and to compare this with the annual increment of the forest. Utilization drain, as used in this report, includes both the material cut and utilized and the sound usable material in felled trees left in the forest after logging. Material cut from limbs or from dead or cull trees is not included. In table 13 the drain on the sawtimber section of the tree, including both the used and wasted portions, is shown in board feet lumber tally, while the volumes given in cubic feet inside bark include the drain on material in small trees, in the upper stems of sawlog-size pines, and in sawtimber material.

Table 13. - Utilization drain from sound trees, 1935

Commodity	Sawtimber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	-- Thousand board feet --			-- Thousand cubic feet --		
Lumber	206,700	94,200	300,900	38,560	13,560	52,120
Cross ties	28,000	28,200	56,200	4,970	4,210	9,180
Poles and piles	9,400	1,500	10,900	1,800	230	2,030
Cooperage	-	5,900	5,900	-	840	840
Misc. manufactures	-	3,500	3,500	-	510	510
Pulpwood	96,600	-	96,600	29,100	-	29,100
Fuelwood	80,700	12,600	93,300	25,400	2,890	28,290
Fence posts	1,400	300	1,700	480	60	540
Misc. farm use and land clearing	44,300	20,700	65,000	12,450	7,710	20,160
Total	467,100	166,900	634,000	112,760	30,010	142,770

Comparison of Increment and Drain

The net effect of growth, mortality, and utilization drain upon the sawtimber growing stock is shown in table 14. The volumes given are of sawtimber material only, and are expressed in green lumber tally.

It is apparent that the pine growing stock was reduced in volume during 1935, when the utilization drain exceeded the increment by 19 million feet. With the reduced growing stock at the beginning of 1936 and a utilization drain that is estimated to have increased from 20 to 30 percent over 1935, the pine growing stock continued to decrease in 1936. Unless the cut is reduced or the growth rate is increased, the inventory and the increment will continue to diminish for at least the next several years, since the incoming body of young timber is not sufficient to create a favorable balance during this time. As may be seen from the chart and text on page 5, the growing stock of the unit is far below its possibilities in average stand per acre, and consequently the total annual increment is perhaps less than half of what it might be. Furthermore, as is seen in figure 1, the present stand is lacking in a satisfactory representation of trees in the larger diameter-classes. To approach a more normal stand and increment it is highly desirable that a part of the present annual increment be reserved from cutting and left to accumulate and build up the growing stock in both volume and quality.

Table 15 expresses the balance between increment and drain in cubic feet inside bark. The volumes shown here include the sawtimber volume of table 14, and in addition sound trees under sawlog size and the upper stems of merchantable pines. It will be noted that in this class of material also, there is a difference between pine increment and drain of over 20 million cubic feet. Furthermore, it can be expected that this deficit will increase through 1937 because of the increased activity of the established industries, and with the completion of the new pulp mill at Spring Hill in 1938 the cubic-foot drain will be even greater. Analysis of the reserve stock of small trees indicates that this disparity between increment and drain will continue if a drain equal to that of 1935 is removed annually from the forest and if no effective steps are taken to increase the increment.

Table 14. - Balance between increment and drain of sawtimber material

	Pines	Hardwoods	Total
	Thousand board feet		
Net growing stock, January 1, 1935	6,975,100	4,671,500	11,646,600
Growth, 1935	502,300	251,300	753,600
Mortality, 1935	54,200	50,500	104,700
Forest increment, 1935	448,100	200,800	648,900
Utilization drain, 1935	467,100	166,900	634,000
Net change in growing stock, 1935	-19,000	33,900	14,900
Net growing stock, January 1, 1936	6,956,100	4,705,400	11,661,500

The situation in respect to the hardwood species is somewhat more favorable than that in respect to the pines. The increment of the hardwoods, as shown in table 15, exceeded the drain by 30 million cubic feet, or to state it in another way, the drain in 1935 was only half the increment. At first glance this seems to reflect a desirable situation, but in reality a major portion of the drain is coming from large, high-quality timber, while much of the increment is accruing upon young second-growth trees, often of poor quality, and frequently of low value, under present standards of hardwood utilization. If full use is to be made of the increment now accumulating in the hardwood stands, new methods must be devised for utilizing second-growth timber that is smaller and of lower quality than that customarily used in the past.

Table 15. - Balance between increment and drain in cubic feet

	Pines	Hardwoods	Total
	Thousand cubic feet (i.b.)		
Net growing stock, January 1, 1935	1,885,890	1,548,120	3,434,010
Growth, 1935	112,190	82,190	194,380
Mortality, 1935	19,670	21,830	41,500
Forest increment, 1935	92,520	60,360	152,880
Utilization drain, 1935	112,760	30,010	142,770
Net change in growing stock, 1935	-20,240	30,350	10,110
Net growing stock, January 1, 1936	1,865,650	1,578,470	3,444,120

Outlook for the Future

The forests in this unit are being cut at the present time faster than they are growing, particularly the pine stands, which, as previously shown, are being reduced each year, when measured either in board feet or in cubic feet. The increment on the hardwood growing stock was sufficient to meet the requirements of the forest industries in 1935, but with the subsequent increased industrial activity in 1936 and 1937, it is reasonable to suppose that the hardwood species are now being overcut. Continued overcutting, with a consequent reduction in the growing stock and increment available for utilization, will mean a growing scarcity of timber and a change in the character and size of the wood-using industry. It should be realized, of course, that the above situation applies as an average to the unit as a whole, and that many local situations may differ greatly from these general findings, ranging from those in communities depleted of their timber resource to others in communities still capable of increasing their present cut without exceeding the annual increment.

An analysis of the board-foot drain on the forest in 1935 shows that about half is caused by the lumber industry, mills with a capacity of more than 40M per day producing 36 percent of the lumber cut. Such mills draw heavily on the remaining supply of the larger trees that contain high-quality sawtimber. Reference to figure 1 shows that the basal area of the larger sawtimber trees makes up a very minor portion of the stand in the pine-hardwood types. If overcutting continues, the supply of such trees will inevitably become so reduced that the large sawmills will be driven from the unit. An increasing amount of the lumber cut has been produced by portable mills, and this trend will undoubtedly continue. These small operators can move readily from place to place and utilize trees of very small diameter, but since they seldom own any land and have few permanent ties, they are little impressed by the need for conservation in any one location. The presence of a large and growing number of such mills in the unit must be recognized as a threat to the future development of the forest, since they tend very definitely to reduce the forest to a stand made up predominantly of small trees. This tendency is accentuated by the development of the pulp and paper industry, which competes directly with the portable mills for the smaller timber. To protect themselves against an otherwise inevitable shortage of large trees, lumber companies that wish to continue in business, must deliberately embark upon a program of growing high-quality sawtimber on lands managed for that purpose. It is not necessary to depend upon planting to obtain a new stand of trees, as there are now large areas of second-growth timber (owned in part by lumbermen) which can be handled under selective logging methods to produce quality timber within a reasonable time.

The wood-pulp industry, which is already an important factor in the forest economy of the unit, is destined to have an increasingly important place. Its continued expansion may result in establishing the stumpage price of pulpwood at a point where adequate returns will accrue to forest owners. Reference to figure 1 shows that there is a greater basal area in trees 8 and 10 inches d.b.h. than in other size-classes on an average acre in the pine-hardwood types. In this respect the stands of the unit are rather favorably stocked for pulpwood production, but the stand per acre can, and should, be greatly increased. While no adequate measure of the optimum stocking is available, figure 2 shows that the cubic-foot volume of the average acre in the pine-hardwood types is less than half of the volume attained by the upper 10

percent of the stands. In order to increase the growing stock and increment, build up a permanent timber supply, and control to a large extent their future wood costs, pulp companies should increase their land holdings so that at least half of their requirements can be produced eventually on their own lands. Skillful buying to include well-stocked stands on the better sites, combined with forestry measures designed to increase the growing stock and the productivity of the forest, should keep the investment in land at a minimum.

Although the forests are at present in a condition of rather low productivity because of frequent fires and short-sighted methods of cutting, the natural growing conditions are so favorable that it is possible, even now, to change the present shrinking timber supply to an increasing resource that will continuously supply to the people of the unit raw material, employment, and a means of profitable land use. It is, however, high time that the forest industries of the unit realize that their future timber supplies must come from the lands around them and not from distant stands of virgin timber. It is equally important that forest owners realize that the demand for timber has developed to the point where the intelligently planned use of their formerly neglected timberland will be found profitable. Until the growing stock of timber and the resulting annual increment has been increased through better forestry practices, it would seem to be sound policy for State authorities to develop new forest-using industries only when it is definitely known that their requirements will not exceed the productive capacity of the forest. An intensive study of the timber resource of the unit might show that further expansion in certain forest industries would be at the expense of already established plants. On the other hand, there are wood-using industries that could be developed to use material now generally going to waste. From every angle of consideration it is apparent that the timber resource of this section of Louisiana is destined to have an increasingly important part in the future economic and social security of the people of the State. A widespread intensification of the efforts of public agencies to give the forests adequate fire protection, to plan for the future development of local industries, to educate forest landowners, and to promote forestry research, therefore, is both justified and imperative.